

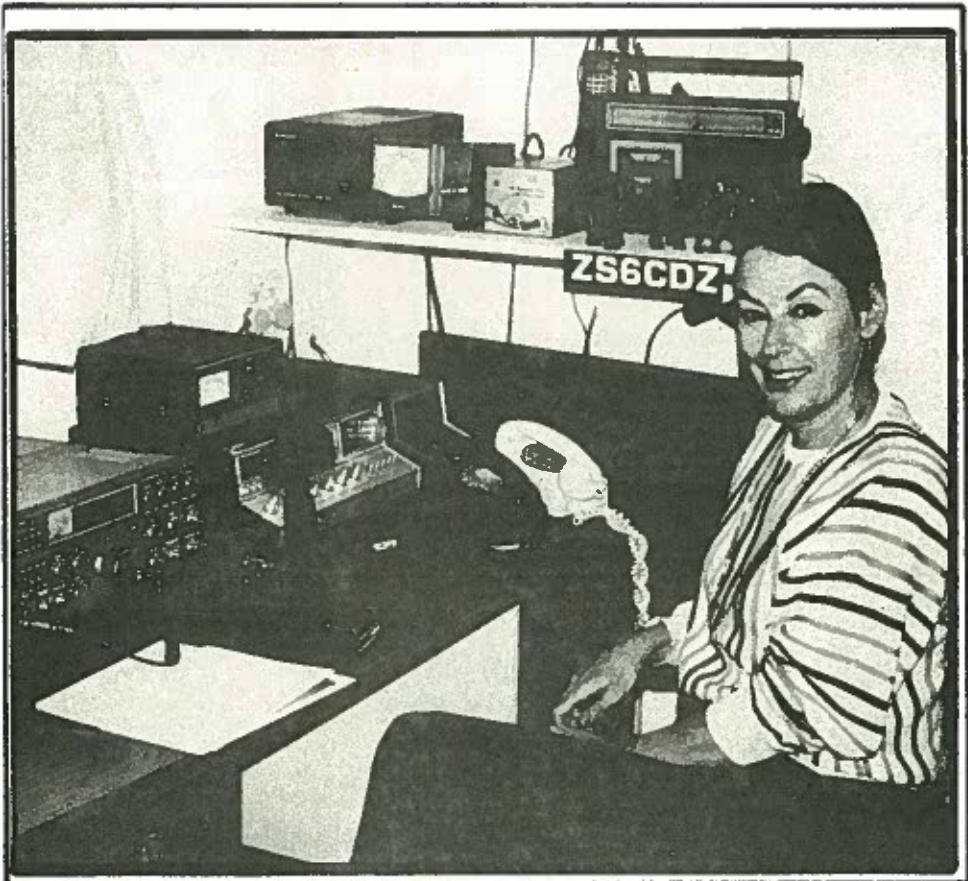


ZS6TJ CALLING

JOHANNESBURG



JULY 1986



INSIDE:

- * AS I SEE THINGS – ZS6BYM
- * ANTENNA MATCHING UNITS – ZS6KE

5TJ CALLING

lished every alternate month by the Johannesburg branch of the South African Radio League.

Postal Address:

O. Box 2327
Johannesburg 2000

Johannesburg Amateur Radio Centre:

1 Duff Road and Louis Botha Avenue, Houghton, Johannesburg.

Telephone No:

2-2041

Office (09h00 - 16h00)

2-6422

Emergency Callhouse Emergencies:

2-7329 849-1546

Meetings:

Weekdays:

100	3720 kHz
	7080 kHz
	14280 kHz
	145,650 MHz

Weekdays:

130	3720 kHz
	145,650 MHz

Amateur Radio News

late:

Weekdays to Saturdays:

06h25, 07h25, 08h25,
09h25, 17h25, 19h25

CQ DE ZS6AKV

Although the sun-spot cycle has now reached its minimum, some of the new sun-spots appearing (very few and very weak) seem to indicate that we are now on the upward trend. It will, however, still be a few years before we can say that DX conditions have returned to normal. Yet despite this lull in DX activity, there are many aspects of Amateur Radio to keep us involved and it is true to say that we are still riding the crest of the wave. To prove this, just look at the diary of events and the kind of interesting things that are being done at the Johannesburg Amateur Radio Centre!

To continue to do this, we need your input and involvement, not just your donations, but also your physical attendance. Just think of the things you are missing!

At the end of July, we are starting our Young People's Amateur Radio Club and monthly get-togethers of young radio amateurs and young people showing an interest in the hobby. If you know of some young person interested in radio and electronics, why not bring him along on the last Saturday of the month at 14h00!

Subscriptions were due at the beginning of July and I would like to thank those of you who were so prompt in sending in your cheques. Thank you for your support and donations. Many of the things we are doing at the Johannesburg Amateur Radio Centre are capital intensive and we, therefore, appreciate your financial support.

Our Annual General Meeting will take place on August 27th. I look forward to seeing you there!

73 et 88

HANS ZS6AKV

FRONT PAGE:

SALLY ZS6CDZ CAN REGULARLY BE HEARD ON THE HF BANDS OPERATING ZS6JCF, TELLING THE WORLD ABOUT THE JOHANNESBURG CENTENARY.

AS I SEE THINGS !

by Wolfy Matz ZS6BYM



I used to be, until about five months ago, a regular contributor to Radio ZS. But now, Radio ZS apparently refuses to publish my articles. Is it because I offend the editor and certain members of the League by writing in what is termed a "jocular and light-hearted manner?"

At least, I assume this is the reason for the non-appearance of my contributions. No one, including the editor of Radio ZS, has had the courtesy to write to me, or telephone me, to give me any reasons as to why my articles have been in the possession of the editor for over five months without publication. This lack of courtesy to a regular contributor is very disquieting and I hope other contributors will not be subjected to the same discourteous treatment!

If by chance the Radio ZS editor or any other of the stern minded League members, who frown on articles that may give enjoyment to Radio Hams, should read this magazine, I suggest they skip the following article. I would hate to cause them pain and suffering, knowing that some Hams actually face life with a smile and don't consider their hobby to be so technical as to exclude a sense of humour.

My grateful thanks to the editor of "ZS6TJ CALLING" for accepting this article. It shows he is tolerant and does not publish only what he considers to be good for Hams, but allows his contributors freedom of expression.

I hope those of you who have read thus far, will enjoy

"A COMMITTEE MEETING"

It is not often that I visit my Uncle Howard, but this was a special occasion. I had heard he had been released from his straight-jacket and was spending his first day out of the padded cell in what is politely called a "rest-home".

I arrived at the home and was taken to my uncle by a nurse. It was apparently tea-time when I arrived and as my uncle was about to partake of his beverage, he invited me to join him.

"This is my nephew, Wolfy," he informed the nurse. "Bring him a padded cup of tea. He too is a Ham."

"Not tea," I corrected. "I would rather have coffee, black, no sugar and two lumps of ice." The nurse took a step back, gazed at me in a peculiar manner and retreated hastily.

"I was going to tell her I use the ice to cool my coffee, because I don't take milk."

faced my uncle. "So tell me nunks, what caused you to end up here
we're the mean wear white coats and use straight-jackets as underwear?"

ommitee meetings," stated my uncle sadly, and brought me up to date
the underlying events that caused his incarceration in this home.

ring reached retirement age, my Uncle Howard decided to spend his re-
ning days in a small seaside village. He found there were eight
ier Radio Hams in the area. They had formed a committee and he was
ited to join it. He did not anticipate he would be elected Chairman
the very first committee meeting which he attended, but took the job
h as much aplomb as he could muster.

found the chairmanship an uphill climb, but persevered - until a par-
ularly difficult meeting. All members were present except for a most
uliar person called "Edgar", who was in charge of entertainments.
everyone was busy squabbling in their normal manner, my uncle banged
gavel and yelled, "Order!". In unison, as always, all present
wered, "Nine Beers".

t was when the first string of my uncle's sanity gave a violent twang
snapped. "Don't say that everytime," he screamed. "All right, let's
rt."

uncle gazed in dismay as tears streamed down Mrs Goodall's face. She
the local post-mistress and also club secretary.

n't cry," he begged, "I didn't mean to shout. "I'm not crying," Mrs
dall returned. "Someone is smoking and I'm allergic to it." She
red at the offending member until he extinguished his cigarette.
t then Edgar entered.

"I RESIGN!"

u're late," my uncle informed him. Edgar looked miffed. "No one
ks to me like that," he yelled. "I resign!"

u can't resign," countered my uncle. "If you resign we have to call
elections and as our club consists of nine people, and the committee
nine people, you are automatically re-elected." My uncle turned to
l, the treasurer.

ght," he asked, "can you tell us the state of our finances?"

re," answered Bill. There was a silence. "Well?" said my uncle.

ll what?"

at are the state of our finances?"

tten," answered Bill.

uncle looked towards the heavens, seeking strength, and trying to
trol his temper, which at the best of times was of an explosive na-
e.

u are," he informed Bill, "an accountant. Surely you can be more
cific than 'rotten'."

ll, not at the moment."

ANTENNA MATCHING UNITS

by W. Wagner ZS6KE

hen I carried my first transceiver home, I had no idea what was involved to be able to get on the air as regards antennas and feed lines! I used formulae from the ARRL Antenna Handbook to construct a multi-element dipole for 40 to 10 metres. When this was connected to the transmitter via a standing wave ratio bridge and some coax, it turned out that none of the elements resonated anywhere near their design frequency.

fter spending about 3½ weeks to tune and trim the elements, I had a reasonable match on some bands. However, the antenna exhibited a very sharp standing wave ratio curve on all bands, which limited efficient operation. An antenna matching unit seemed to be the only way out. This would have to match the existing dipole to the transceiver. However, I also wanted to use the same unit on holiday trips to match long wire antennas.

Various designs for antenna matching units were investigated and built bread-board style. The following emerged:

- Any antenna matching unit represents a more or less inefficient compromise.
- All antenna matching units introduce losses.
- Matching units never turn a bad antenna system into a good one.
- The matching unit may prevent interference, but it can just as easily increase interference excessively if the tuning is carried out incorrectly, if the design is not suitable for the antenna system, or if it is not properly connected to the station.
- A matching unit does not improve standing wave ratio problems on feed lines and antenna systems.
- The ideal position for an antenna matching unit is as close to the antenna's feed point as possible.
- Components with the required ratings for antenna matching units are not easily obtainable.

The background to the matching problem:

A well-known theorem for DC circuits states that maximum power will be transferred from a source to its load if the load resistance equals the source resistance. To prove this is simple. Consider a circuit with a DC source having an internal resistance of 1 Ohm and connected to a variable load resistance. When we draw a graph of the power in the load resistance, it becomes apparent that maximum power is transferred when the load resistance equals the internal resistance of the source, ie. the power curve peaks at this point.

When dealing with AC circuits, the same theorem applies. However, now the theorem states that maximum power transfer from a source to its load occurs when the load impedance is equal, but opposite to the source impedance. This simply means that the complex impedance has the same real part and an equal but opposite reactive part.

us the primary objective of any impedance matching scheme is to force the load impedance to "look like" the complex conjugate of the source impedance, so that the maximum power may be transferred to the load.

st modern transmitters, receivers and transmission line components are designed for an impedance of 50 Ohms.

lid state power amplifiers usually employ broad-band interstage and output circuits. They require no tuning, BUT they will deliver maximum power output only when connected to a resistive load with a very low standing wave ratio. Even standing wave ratios of the order of 1.5:1

2:1 will severely reduce power output due to the built in protection circuit, the ALC or automatic level control. This limits the power output from the final amplifier as the standing wave ratio increases.

nce most high frequency antenna and transmission line systems do not provide a flat standing wave ratio over the extremes of every band, it usually means that some form of matching unit is required between the transmitter and the transmission line.

y antenna system may theoretically be represented by some arrangement consisting of an inductor, a capacitor and a resistor. This will exhibit some basic resonant frequency. At resonance, this network will have characteristic impedance which is purely resistive, that is the input impedance at the termination of the feed line.

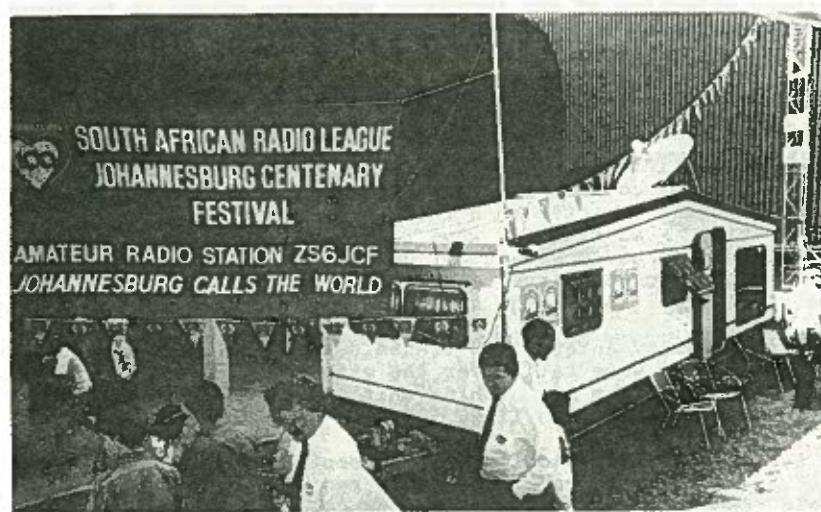
en a variable frequency is applied to this network, then the impedance of this circuit will change as the frequency is changed.

the rate of change of this impedance depends on the capacitive, inductive and resistive values the antenna system presents at its feed point. In the applied frequency is not equal to the resonant frequency, the impedance at the feed point will become complex, that is, as the length of the antenna becomes shorter with respect to the wavelength, it will exhibit a more capacitive impedance and as the length becomes longer, will present a more inductive impedance. The non-resistive components of the complex impedance have to be compensated for by some means of impedance transformation to match the purely resistive 50 Ohm impedance of the station to the antenna system. This may be done by some combination of discrete inductances and capacitances, which represent variable impedance transformer.

uctive components may be tuned out by a capacitive reactance of equal impedance and capacitive components may be eliminated by an inductive reactance.

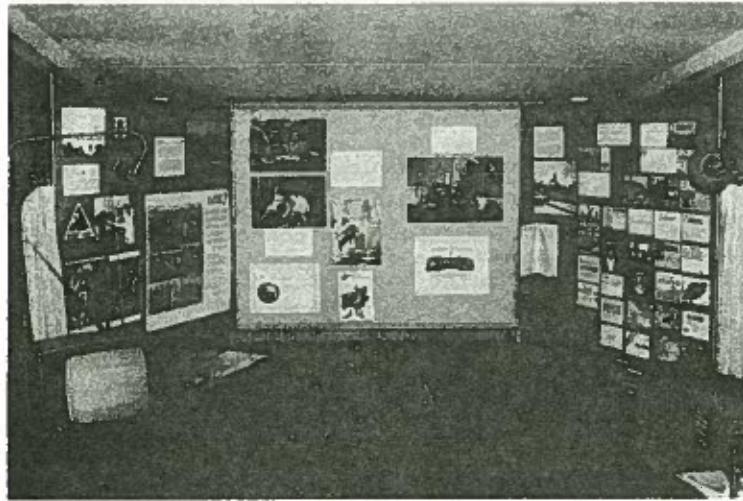
As "matching network" of inductances and capacitors will exhibit a certain 'Q' or quality factor, which is determined by the resistance of the inductance used. In practice, the 'Q' of the matching circuit should be as low as possible. This ensures that the circuit will require minimal readjusting when the applied frequency is shifted within the band. However, this represents a trade-off as the low 'Q' also means that the network provides only limited suppression of harmonics. When tuned correctly, this matching unit may add some harmonic suppression and, therefore, reduce interference and will prevent damage to the finals of the transmitter. The transmitter can be loaded properly at any frequency, although the standing wave ratio presented to the matching unit changes.

he percentage of power of the transmitted power will still be lost due to the standing wave ratio present in the antenna system, but more over-power will be radiated.



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JOIN THE JOHANNESBURG BRANCH
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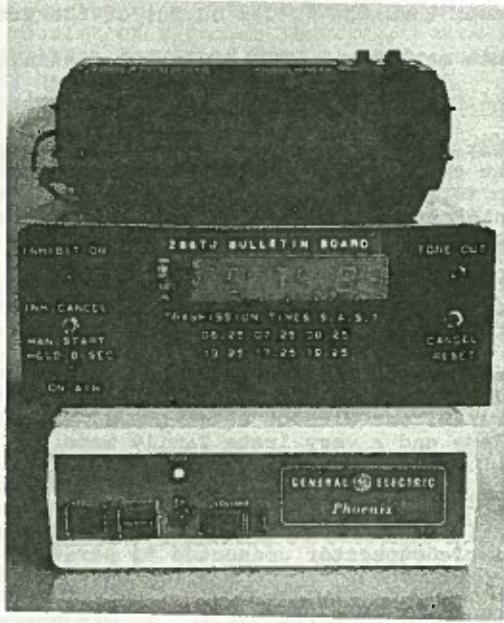


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OUR STUDENTS
THE HIGHEST
1985 AMATEUR
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IMPRESSIONS OF THE ZS6JCF
BITION AT THE RAND SHOW.



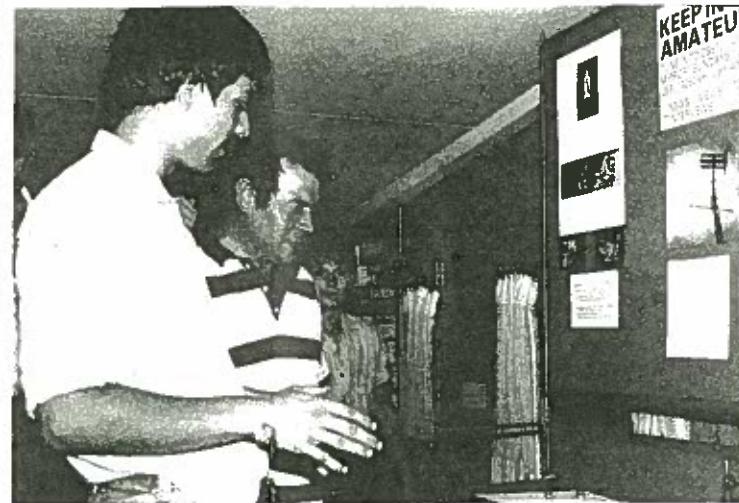
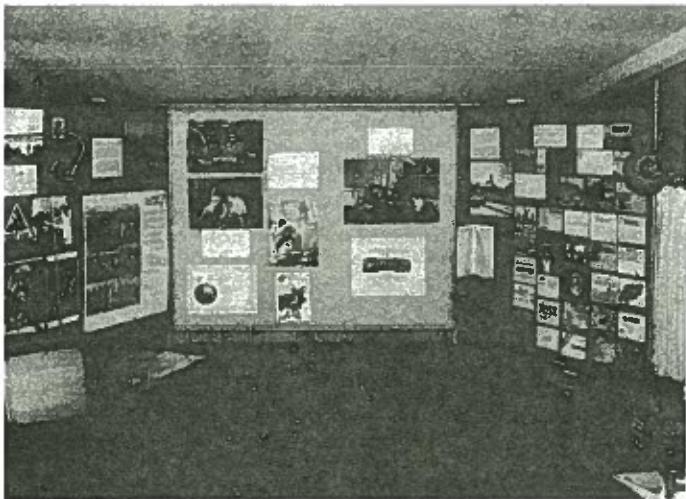
THIS IS THE EQUIPMENT THAT PUTS
OUT THE DAILY AMATEUR RADIO NEWS
UPDATES.

SOUTH AFRICAN RADIO LEAGUE
JOHANNESBURG CENTENARY
FESTIVAL
EUR RADIO STATION ZS6JCF
JOHANNESBURG CALLS THE WORLD



ARLAND USSHER GOLD PEN AWARD

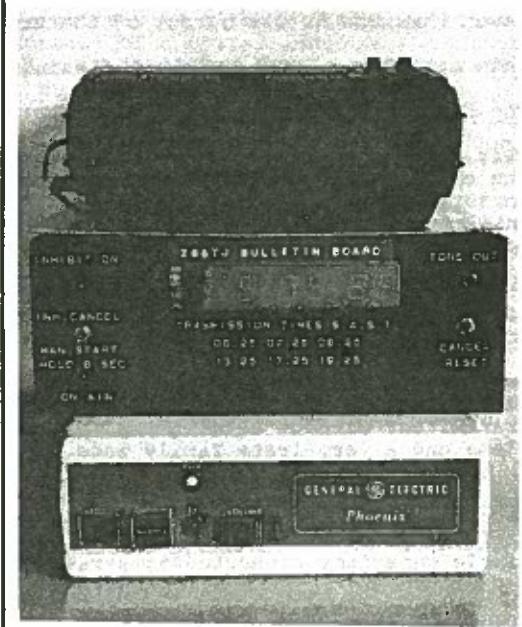
SOLLY FARBER, ONE OF OUR STUDENTS OF LAST YEAR ACHIEVED THE HIGHEST MARKS IN THE NOVEMBER 1985 AMATEUR RADIO EXAMINATION. THE PICTURE SHOWS ZS6AKV PRESENTING HIM WITH THE ARLAND USSHER GOLD PEN AWARD. LOOKING ON IS PETER ZS6CET, WHO AT THE TIME WAS CHAIRMAN OF THE EDUCATION COMMITTEE.



JOIN THE JOHANNESBURG BRANCH
WE MAKE AMATEUR RADIO HAPPEN



SOME IMPRESSIONS OF THE ZS6JCF
EXHIBITION AT THE RAND SHOW.



THIS IS THE EQUIPMENT THAT PUTS
OUT THE DAILY AMATEUR RADIO NEWS
UPDATES.

connect these taps to the contacts of a multi-position switch. The switch required must have reasonably heavy contacts for the same reason stated for the clips. Connect the common pole of the switch to that end of the coil, which has the widest spaced taps. Thus the unwanted part of the coil is shorted out by the switch. Some types of multi-position stove switches work well in this application.

Some variable capacitors are also required:

These proved more difficult to locate than the coil above. Here ZS6TJ's workshop came to the rescue and after a single call, I obtained the necessary units. Capacitance values from 200 pF work nicely.

For output powers in the range of 50 to 200 watts, it is possible to use interspaced broadcast type variable capacitors from older receivers. With these capacitors matching must be carried out at low powers, maximum power may only be applied to the matching unit once the best match has been established. If the standing wave ratio is high, flashover may occur due to the small spacing between the plates of broadcast capacitors if the tune-up is performed with maximum power.

If high powers are used, then transmitting type variable capacitors with spacings rated for 3 000 to 6 000 volts are necessary. This means that capacitor plates should be spaced more than 4 mm apart.

Construction Hints

fully enclosed chassis of suitable size is required. The two series capacitors must be mounted so they are insulated from the chassis. Locks of plastic work nicely. However, please ensure that the mounting hardware does not get too close to the capacitors and that the spacing of the capacitors from the chassis exceeds the plate spacing between capacitors.

The control shafts of capacitors should be attached to the front by insulated shaft couplers. If these cannot be located, then solid plastic knitting needles of 6 mm diameter will work just as well.

Ensure good grounding between the chassis and any ground connections. The chassis must also be connected to the station ground to prevent RF burns and interference!

Provide a ground stud on the chassis of the tuner with a wing nut to connect to the main station earth.

If fixed parallel capacitors have to be used, then only the very best ceramic capacitors rated for 4 kV or more should be used. For low capacitor values sections of coax may be used if capacitors cannot be located.

Insulate all connections as well as possible. The inside dielectric from old coax works well. When I used ordinary PVC insulation on these connections and one of the coil taps came close to the output connection it burst into flames. The coil should be mounted at least its diameter away from the chassis to prevent a marked loss in 'Q'.

Finally some tuning hints

Connect the transmitter to a standing wave ratio bridge and connect this to the matching unit. Then connect your antenna to the output of the matching unit.

Adjust all capacitors on the matching unit to mid-range.

Adjust the output power of the transmitter to the lowest value which provides a suitable standing wave reading on the standing wave ratio bridge. An output power of 2 to 5 watts is normally sufficient and will reduce interference with other stations operating on the band.

Adjust the coil taps until you see a dip in the standing wave ratio. Remember, never change any switch settings while the transmitter is on. This might damage the transmitter or the matching unit.

Once the dip is obtained adjust the capacitors for a low standing wave ratio. It should be possible to obtain a 1:1 match at any frequency setting of the transmitter.

Decrease the sensitivity of your standing wave ratio bridge to indicate the final power to be used.

Increase the output power of the transmitter to maximum.

Readjust the capacitors to obtain the best match at high power.

Whenever the operating frequency is changed, this procedure should be repeated, especially when changing bands.

would like to state again that additional losses due to the standing wave ratio presented by an antenna system must not be over rated:

standing wave ratio of 3:1 will add approximately 1,3 dB of losses and even at an SWR of 5:1, the additional losses are only of the order of 2 dB.

sincerely hope that my experiences while building my own antenna matching unit will be of some assistance to those of you who intend building your own.



The cover picture shows the skyline of Johannesburg, Africa's largest city of nearly two million people. A city which can rightfully claim to be a major world financial centre and the place which, just a short one hundred years ago, was found to contain the world's richest deposits of gold.

In those 100 years, Johannesburg has de-

veloped into a cosmopolitan, bustling city, which symbolizes the basic dynamism of Africa today. The call ZS6JCF has been designated for this Centenary Johannesburg Year, and we look forward to hearing from you again and again so that we may impart some of the excitement about our city to you in yours.

SOUTH AFRICAN RADIO LEAGUE

JOHANNESBURG BRANCH

D I A R Y

Johannesburg Amateur Radio Centre, Cor. Duff Road and Louis Botha Avenue,
Houghton.

JULY 16	SA AMSAT MEETING	Peter ZS6ET
Wednesday 20h00	"Getting ready for JAS-ONE" - full details on how to operate the satellite (to be launched 30/7/86).	
JULY 18	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
Friday 16h30		
JULY 19	OPEN DAY.	Tony ZS6AOG
Saturday 10h00 - 18h00	<ul style="list-style-type: none">- Videos on Amateur Radio at 11h00, 12h00, 13h00.- Shortwave Listening Meeting at 14h00.- Demonstrations on Amateur Radio, Satellites, Packet Radio and Weather Satellites.- Braai fires from 12h30.	Gus ZS6GT Gerald ZS6BTD Ron ZS6AVY
JULY 23	CLUB EVENING.	Geoff ZS6BBF
Wednesday 19h00		
JULY 24	Start of Course 3/86. Start of Morse Lessons.	Geoff ZS6BBF Bob ZS6AEV André ZS6BZY
Thursday 8h00		
JULY 25	FRIDAY CLUB.	
Friday 6h30		
JULY 26	"YOUNG AMATEUR CLUB" (for the want of a better name!) All young radio amateurs/SWL and enthusiasts not yet licensed (scho- lars and students, i.e. under 25) are invited.	Hans ZS6AKV Ron ZS6AVY Anita ZS6CAF
4h00		
5h00	John Williscroft ZS6EF will talk on "Using Amateur Radio as a springboard into an electronics related career."	

ULY 30 ednesday 0h00	CLUB EVENING.	Gerald ZS6BTD
ULY 31 hursday 8h00	Course 3/86. Morse Code lessons.	Geoff ZS6BBF Bob ZS6AEV André ZS6BZY
UGUST 1 riday 6h30	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
UGUST 2 aturday 0h00	06h30 BACAR CONTROL. 14h30 Eye Ball Swap Shop (JARC opens for exhibitors at 13h30)	ZS6EF ZS6ARG ZS6BTD ZS6BBF
UGUST 6 ednesday 0h00	CLUB EVENING. - Library open.	Ron ZS6AVY
UGUST 8 riday 6h30	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
UGUST 9 aturday 0h00	WORK PARTY.	ZS6BTD ZS6AKV ZS6AOG and Committee.
UGUST 11 unday 8h00	Long course 86.	Gunter ZS6BWD Arie ZS6UY
UGUST 13 ednesday 0h00	CONSTRUCT A MORSE CODE OSCILLATOR WITH ZS6AKV.	Gus ZS6GT
JGUST 14 hursday 8h00	Course 3/86 Morse Course.	Geoff ZS6BBF Bob ZS6AEV André ZS6BZY
JGUST 15 riday 6h30	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
JGUST 16 aturday 0h00	SWL Forum with the SADX Club.	Tony ZS6AOG

AUGUST 18 Monday 18h00	Long course.	Gunter ZS6BWD Arie ZS6UY
AUGUST 20 Wednesday 20h00	SA AMSAT MEETING TELEDATA - THE IN'S AND OUT'S WITH PRACTICAL DEMONSTRATIONS. Speaker: Rob Bird, Senior Projects Engineer, SABC.	Peter ZS6ET
AUGUST 21 Thursday 18h00	Course 3/86 Morse Code course.	Geoff ZS6BBF Bob ZS6AEV André ZS6BZY
AUGUST 22 Friday 16h30	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
AUGUST 23 Saturday 14h00	CLUB AFTERNOON "CQ HOU KOERS".	Ron ZS6AVY
AUGUST 25 Monday	18h00 Long course. 19h30 SAATI MEETING.	Gunter ZS6BWD Arie ZS6UY Gerald ZS6BTD
AUGUST 27 Wednesday 19h30	ANNUAL GENERAL MEETING Cheese and wine party.	Gerald ZS6BTD Anita ZS6CAF Gunter ZS6BWD
AUGUST 28 Thursday 18h00	Course 3/86. Morse Code course.	Geoff ZS6BBF Bob ZS6AEV André ZS6BZY
AUGUST 29 Friday 16h30	FRIDAY CLUB.	Tony ZS6AOG John ZS6EF
AUGUST 30 Saturday 14h00	YOUNG RADIO AMATEURS' CLUB.	Hans ZS6AKV
SEPTEMBER 1 Monday 18h00	Long course.	Gunter ZS6BWD Arie ZS6UY
SEPTEMBER 3 Wednesday 20h00	HOW ARE PROPAGATION PREDICTIONS PREPARED AND HOW TO USE THEM.	Gerald ZS6BTD

SEPTEMBER 4 Course 3/86
Tuesday C W Course.
3h00

Geoff ZS6BBF
Bob ZS6AEV
André ZS6BZY

SEPTEMBER 5 FRIDAY CLUB.
Friday
1h30

Tony ZS6AOG
John ZS6EF

SEPTEMBER 6 CLUB AFTERNOON.
Saturday
1h00
2m "SPRINGTIME" DF HUNT.
Fox hide at 14h00 and transmits
on 145,550 MHz.
At 16h00 report your position to
ZS6TJ on 145,650 MHz and meet at
the JARC at 16h30.

TOP PRESS * STOP PRESS * STOP PRESS * STOP PRESS* STOP PRESS* STOP PRESS

GENERATIVE RECEIVER KITS

ts are again available at R45-00 each. Send Orders to SARL
O.Box 2327, Johannesburg 2000.

S-ONE LAUNCH

AMSAT WILL PROVIDE LIVE COVERAGE OF THE JAS-ONE LAUNCH ON
NDAY AUGUST 3rd STARTING AT 22H00 SAST ON THE CENTRAL WITS
PEATER AND ON 3720 and 7080 KHz.

NEW FROM KENWOOD

THE WORLD'S LEADER IN
AMATEUR RADIO EQUIPMENT

"THE SATELLITE TWINS"

-METRES 70-CENTIMETRES
TS-711E, TS-811E

RPT switches

- TONE: Used to TS-711E tone control
- OFFSET: Used to select 400 kHz (TS-711E)

MODE/Ten keys

- MODE: Mode selection on FM, USB, LSB, CW accommodated through use of mode keys, with adjacent LED. "Trans" entered in mode is announced in International Morse Code

- AUTO: Automatically selects the appropriate mode, depending on the frequency

- SCAN: Use to activate or stop scan

- M. IN: Used to store data in memory channel

- REV & LOCK: Used to lock frequency out of dial and key code operation. In SPLIT memory channels transpose the receive and transmit frequencies during VFO offset operation

- AL: Alert

- CH. S: Provided to facilitate selection of the memory channel in which the operator wishes to store data

- TEN KEY: Used when setting digital code and call sign

★25 WATTS

★COMPACT DESIGN

★DUAL VFO'S

★40 MEMORIES

FUNCTION switches

- CH. Q: Tuning character varies from conventional VFO feel to step-burst action

- A,B: VFO A and B

- STEP: Tuning step frequency in VFO

- SPLIT: Allows receive/transmit operation of VFO A and B only in VFO mode

- A=B: Permits quick shifting of the B VFO data to the A VFO, or vice-versa

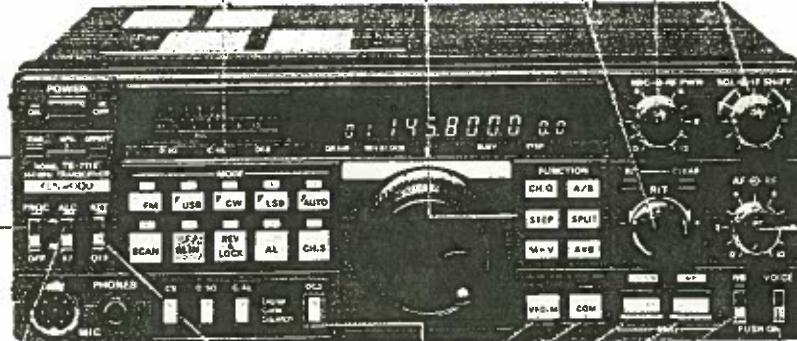
- M>V: Used to transfer memory data to the active VFO

RIT control: Shift the receive frequency in 10 Hz steps within range of ± 0.9 kHz

MIC → RF PWR controls

SQL → IF SHIFT controls

AF → RF controls



ALC/RF: Used to select RF or ALC meter.

ATT: Attenuator (-20 dB) (TS-711E)

PROC: Used to increase average modulation ratio in FM mode and to increase talk power in SSB mode.

DCS switches

- DCS: Used to activate DCS system.

- D. SQ: Used to activate digital code squelch with DCS switch-ON.

- C. AL: Confirmed by sounding of triple beep tones when the digital code switch opens. Used to set up call sign with CS switch-ON

- CS: Used when setting digital code.

VOICE: Announces the frequency or digital code when an optional VS-1 is installed inside the cabinet.

NB (Noise Blanker)

DOWN/UP: Shifts 1 MHz up/down.

COM: Present for COM channel.

VFO/M: Used to switch alternately between VFO and memory channel.

CALL IN AND SEE THESE
MAGNIFICENT RADIOS TODAY
OR WRITE FOR COLOUR BROCHURE

THE ULTIMATE IN VHF-UHF TRANCEIVERS.

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ELECTRONICS (PTY) LTD

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Telephone: 29-8354/8 Telex 4-85613 SA

DURBAN

1008 Metal Industries House, 15 Ordnance Road, Durban 4001 Telephone: 37-7705
P.O. Box 11386 Marine Parade 4056.

KENWOOD